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No. 95

July 1968

RESOURCE MANAGEMENT REPORT

ONTARIO

DEPARTMENT OF LANDS AND FORESTS

HON. RENE BRUNELLE
Minister

G.H.U. BAYLY
Deputy Minister

No. 95

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FISH AND WILDLIFE BRANCH

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SURVIVAL AND GROWTH OF WALLEYE FRY AND FINGERLINGS FED A DIET OF BEEF LIVER AND TROUT PELLETS

by
W.F. Cheshire and K.L. Steele

Abstract

It has now been clearly demonstrated that walleye fingerlings can be trained to feed on an artificial diet and survive. In addition, walleye fingerlings have been trained to feed on trout crumbles. At present it appears the most promising development in walleye rearing methods will take place through rearing walleye in fertilized ponds for about one month, then transferring them to troughs where they can be trained to feed on artificial food. Attempts to date to rear walleye on artificial food, starting at the fry stage, have not been successful.

Introduction

Cannibalism has been the main problem to date in pond rearing young walleye (Cheshire and Steele, 1963; Smith and Moyle 1943; Dobie 1956). Young walleye feed on zooplankton and insects during the early part of their life until they reach about 30 mm in length. After this, zooplankters become less important and fish become more prominent in their diet demand (see Figure 4, Cheshire and Steele 1963). Young walleye can be reared in fertilized ponds up to about 35 mm in length for less than one cent apiece (Cheshire and Steele 1963), however, it becomes impractical to pond rear walleye to larger sizes. Pond rearing walleye to about 60 mm in length costs as much as 35 cents apiece (Cheshire and Steele 1962),

Cannibalism could possibly be controlled in ponds if a suitable natural food could be found. Martin (1958) was able to pond rear a small number of walleye, past the stage when they normally turn cannibalistic, by feeding them minnows; this was not found practical for rearing walleye in large numbers. The success of walleye rearing under the above circumstances will depend completely on the supply of food available to feed the young walleye.

It was thought young walleye could be reared beyond the cannibalistic stage if they could be trained to feed on an artificial food that was suitable and readily available. Further refinement could possibly be made if the fertilized pond rearing period could be by-passed. This would avoid training the fish to feed on one type of food and then converting them to another type later on. Whether more walleye could be reared from fewer eggs by by-passing the pond rearing stage is not known at present.

Review

Experimental feeding of young walleye with beef liver and trout pellets was first tried at the White Lake Hatchery in 1965 (Cheshire, 1966). Newly hatched walleye fry were stocked in fertilized ponds and reared to lengths ranging from 44 to 55 mm (1.8 to 2.2 inches). A total of 8,163 fingerlings were then taken from the ponds and placed in troughs where they were fed a mixture of ground beef liver and trout pellets. About five to seven weeks elapsed before the fingerlings fed well on the food presented. Losses were high during the first part of the rearing period, however, this was reduced to less than 5 percent during the last forty days of the experiment. A total of 2,030 fingerlings were reared to lengths ranging from 96 to 102.5 mm (approximately 4 inches), which resulted in 24.9 percent survival.

The data suggested that length growth rates of the young walleye on the liver - pellet mixture varied from 36 to 65 percent of the growth rate found during the earlier pond rearing period.

An attempt was made in 1966 (Cheshire and Steele, 1966) to determine whether walleye fry would survive if they were fed ground beef liver, however, this was not successful. Since the fry were not fed during the first five days after hatching, it was felt more tests were required to determine whether walleye fry would survive if food was made available to them as soon as they hatched.

Purpose

The main purpose of the walleye feeding program is to determine whether young walleye can be trained to feed on an artificial food that is readily obtainable.

The general purpose of the 1967 walleye feeding program was to determine whether the fingerling feeding results obtained in 1965 could be repeated, and whether improvements could be made in the feeding techniques.

The specific purposes of the 1967 feeding program were as follows:

1. Determine whether fry would survive if fed as soon as they hatched. Last year (1966) the fry, which were held in troughs, were not fed during the first five days after hatching.

2. Determine whether more frequent feeding of fingerlings would shorten the conditioning period and improve survival. In 1965 the fingerlings were fed only three times a day, and it required five to seven weeks before the fingerlings started to show signs of growth.

3. Determine the size and time when fingerlings will accept artificial food most readily. Fingerlings were not tested with artificial food in 1965 until they were 44 to 55 mm. in length.

Fry Feeding

Four groups of fry, 25 thousand in each group, were put in separate troughs immediately after hatching and presented with finely ground beef liver and trout crumbles. Three methods of feeding were tried. In the first method, the food was squeezed through a wire screen, 24 wires to the inch, and allowed to float in the water. The food was squeezed through fine bolting cloth in the second method, then floated in the water. The third method consisted of smearing the food around the outside of earthen flower pots, which were inverted and placed in the trough. The fry were fed ground liver alone, and ground liver mixed with trout crumbles and codliver oil. The initial fry feeding experiments are summarized in Table 1.

Observations made on the behaviour of the fry during the feeding experiments suggested the fry were showing some interest in the food smeared on the flower pots. This experiment lasted no longer than 10 days, since all fry had died by that time. The flower pots were kept close together during the feeding period, which resulted in the fry being crowded together. Mortality might have been controlled if the flower pots had been dispersed to some extent after the fry had started to feed.

The bolting cloth and screen methods resulted in the gills of the fry becoming clogged with food particles. Neither of these methods showed any promise.

A second attempt was made to determine whether young walleye could be encouraged to feed successfully on the liver, pellet and codliver oil mixture at a later stage. Young walleye 15.5 mm long were removed from one of the rearing ponds and put in troughs. The screen and flower pot methods were tested as before. The ground beef

liver mixed with trout crumbles and codliver oil was the only food tested. After four days the experiment was terminated, since it was evident this was not going to be successful because of the heavy losses of fry.

Fingerling Feeding Experiments

A total of 9,557 fingerlings, ranging in size from 36.1 mm to 39.9 mm were removed from the ponds and fed artificial food. The fingerlings were tested with 3 food mixtures; ground beef liver, ground beef liver mixed with crushed trout pellets, and crushed trout pellets alone. Fingerlings were fed once every hour for about a month, after which the frequency of feeding was reduced gradually to twice a day. The fingerlings were finally put on a diet of crushed trout pellets six days a week and ground beef liver one day a week.

Survival

Table 11 shows the number of fingerlings put in each trough, loss and survival, and length of the rearing period for each trough. Available data on length of fish when put in and removed are also included.

Table 111 shows loss and survival as percent of the fish put in for each trough. Fish were transferred from one trough to another for convenience in feeding when the number of surviving fish became low. Trough number 6 was an exception; the fish in this trough were relatively large (size not recorded) and it was felt unwise to put them in with smaller fish. In view of this transfer of fish from one trough to another it was necessary to calculate a corrected survival to estimate what the expected survival would be for each separate trough.

A total of 9,557 fingerlings were put in troughs for the feeding experiments. After being reared from periods ranging from 95 to 110 days, a total of 793 fingerlings survived (Table 11). This resulted in 8.3 percent survival for the 1967 program (Table 111).

Table IV compares the over-all experimental fingerling feeding results for 1965 and 1967. Higher survival was achieved in 1965 (24.9%) than in 1967 (8.3%). The fingerlings were pond reared to a larger size (44.0 mm to 55.0 mm) in 1965 than in 1967 (36.2 mm to 39.9 mm) and the fingerlings grew to a larger size in 1965 (96.0 mm to 102.5 mm) than in 1967 (91.9 mm to 95.5 mm).

The records show the 1965 fingerling feeding results were clearly more successful than the 1967 results (Table IV). On the other hand, the fingerling response to feeding in 1965 was much

slower than in 1967. The fingerlings were fed no more than three times a day in 1965, and it required a conditioning period ranging from 5 to 7 weeks before the fingerlings started to feed properly. In 1967 the fingerlings were fed once every hour for the first part of the rearing period; on this schedule it required no more than ten days before the fingerlings began to feed properly. The length of time the fingerlings were fed on an hourly schedule varied between troughs, and ranged from 21 to 50 days; after this the feeding schedule was gradually reduced to twice a day to reduce the manpower requirements for feeding.

Malachite Green Treatment

Heavy mortality was observed during the early part of the feeding trials in 1967 which did not appear to be due to the food, since the fingerlings were feeding well, and the diet used was the same as that used in 1965. It was felt that sanitation may have been the problem, and the fingerlings were therefore treated regularly with malachite green using the flush method. The mortality was reduced considerably as soon as treatment was started. Table V shows the fingerling survival in each trough and the length of time the fingerlings were kept in the troughs before being treated. A comparison of the data for troughs 8 and 10 (Table V) indicate that survival can be improved through regular malachite green treatment. Fingerlings in trough 8 were not treated which resulted in only 10.2 percent survival after 8 days; treatment was started in trough 10 the day after the fingerlings were put in and survival was higher after 12 days. On the other hand, a comparison of data from troughs 12 and 13 (Table V) suggest the significance of regular malachite green treatment to survival may not be too important. A more complete description and examination of the malachite green treatment will be made in a future report.

Cannibalism

Data on numbers of fingerlings put in troughs, the numbers of dead fish removed (loss counted), and the numbers surviving were recorded for a number of troughs (Table 11). The losses unaccounted for were the closest estimates available on losses due to cannibalism. Table 111 indicates that losses due to cannibalism ranged from 2.9 to 12.3 percent during the trough rearing period.

Fingerling Growth and Water Temperature

Data available on fingerling growth, in terms of mean length in mm and number of fish per pound, are shown with the trend in mean water temperature in ^{o}F during the rearing period in Figures 1 to 4 inclusive.

Fingerlings in troughs 9, 11, and 12 showed an initial lag in length growth for the first 7 to 10 days (Figures 1, 2, and 3). Trough 13 (Figure 4) showed an initial lag in weight growth; length measurements were not taken at first to determine whether there was an initial lag in length growth in trough 13.

Figures 1, 2, and 3 indicate that fingerling growth slows down after mean water temperatures drop below 70°F. On the other hand, Figure 4 (Trough 13) shows a similar trend in growth rate during the complete trough rearing period.

Fingerling Feeding Rates

Three different diets were fed to the fingerlings during the rearing period; ground beef liver, ground beef liver mixed with trout crumbles, and trout crumbles alone. The liver and crumbles mixture consisted of 2 parts liver mixed with 1 part crumbles by weight. Codliver oil was mixed with the liver alone and the liver-crumbles mixture at the rate of 5 teaspoons of codliver oil to 13 pounds of food. Feeding rates used for each diet are listed in Tables VI, VII, and VIII, and are expressed as percent of body weight fed over a 24 hour period.

Data from the above mentioned tables were used to plot feeding rates over mean water temperature in Figure 5. These results were not arrived at from tests to determine how much the fingerlings would consume, but were the actual amounts fed the fingerlings during normal hatchery feeding operations at the White Lake Rearing Station. In view of this, there may be some question as to how much the data represent the response of walleye fingerling feeding rates to mean water temperature. It is evident there was a wide variation in feeding rates used when mean water temperatures were above 70°F. A definite drop was noticed in the feeding activity of the young walleye when mean water temperatures dropped below 68°F; the feeding rates were therefore reduced.

Discussions and Conclusions

The main purpose of the 1967 walleye feeding program was achieved; it is now clear that young walleye can be trained to feed on an artificial diet and survive. In addition, it is possible to train young walleye to feed on the same type of food as used in brook trout rearing, i.e. trout crumbles. Survival of 24.9 percent was achieved in 1965 (Cheshire and Steele 1967). Although the fingerling survival for the 1967 program was relatively low (8.3%), it is hoped that Table 111 is some indication of survival that might be attained in the future (46.0% for trough number 6).

Techniques for rearing walleye, starting at the fry stage, have yet to be developed. Attempts so far have been unsuccessful, however, the flower pot method described in this report might be worthy of further investigation. In view of this, it appears the most rapid development of walleye rearing at the White Lake Rearing Station will take place through pond rearing walleye to fingerling size for about one month then putting them in troughs to be trained to feed on ground beef liver and trout crumbles.

There is some indication the bulk of the growth in young walleye takes place when water temperatures are above 70°F. (Figures 1 to 4), and that feeding rates are quite different above 70°F. than they are below this point (Figure 5). If there is a long delay before the walleye begin to feed properly, as was the case in 1965 when a 5 to 7 week conditioning period was required, a considerable amount of potential growth could conceivably be lost while water temperatures are still above 70°F.

The results of attempts to date to have fingerlings feed on an artificial diet can be summarized as follows: The fingerlings were grown to a larger size in 1965, survival was relatively high, but it required a relatively lengthy conditioning period before the walleye started to feed properly. In addition, the fingerlings were fed no more than three times a day during the conditioning period. The 1967 feeding program resulted in lower survival and smaller fish; but it required a relatively short conditioning period, possibly due to the fish being fed once every hour. It is hoped the early conversion success achieved in 1967 can be combined with the higher survival achieved in 1965 to produce a larger fish than was produced in 1967.

The importance of the frequency of feeding to survival requires further study. In addition, the importance of fingerling size before starting to convert them to feeding on artificial food has to be examined more closely.

A start has been made in this report to collect data on feeding rates and temperature. These data will be added to and improved as more experience is gained in the feeding of walleye.

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Table 1

Fry Feeding Experiments

Trough Number	Food	Feeding		When Cannibalism started after Hatching (days)	Length of Experiment in days
		Method	Frequency		
3	Liver, crumbles, oil	Flower pot	hourly	6	10
2A	Liver, crumbles, oil	Bolting cloth	1/2 hour	4	6
1	Liver, oil	Bolting cloth	1/2 hour		5
2	Liver 3 days Liver, crumbles 2 days	Screen 1/24 inch mesh	1/2 hour		5
1A	Liver, crumbles, oil	Bolting cloth	1/2 hour		6

N.B. Fry in troughs 1 and 2 were so few after 5 days that they were combined and continued in 1A. All fry in 1A originated from troughs 1 and 2.

Liver, crumbles and codliver oil used in following ratio: 2 parts liver to 1 part trout crumbles by weight; 5 teaspoons of codliver oil to every 13 lbs. of liver-crumbles mixture.

25,000 fry put in each of troughs 3, 2A, 1, and 2.

Table 11

Fingerling Mortality and Survival

	Trough Number						
	6	8	9	10	11	12	13
Length of fish put in mm.	-	36.2	36.1	38.0	37.6	39.9	-
No. Fish started with	87	1,000	3,000	1060	1000	2910	500
Loss counted	-	-	2,386	551	898	2468	359
No. Fish taken out	-	-	425	102	0	100	
No. Fish added	-	-	102	0	277	0	140
Loss unaccounted for	-	-	86	130	39	234	44
No. Fish surviving	40	102	205	277	340 (3)	108	240
Length fish surviving (mm)			95.5		88.1	91.9	93.5
Length of Rearing Period in days	95	8 (1)	110	12 (2)	95	100	79

(1) Fish put in Trough 9.

(2) Fish put in Trough 11.

(3) Of 340 surviving in Trough 11, 200 sent to Waterloo U and 140 put in Trough 13.

Total fingerlings started 9,557.

Total fingerlings surviving 793.

Table 111

Percent Fingerling Mortality and Survival

	Trough Number						
	6	8	9	10	11	12	13
Length of fish put in (mm)	-	36.2	36.1	38.0	37.6	39.9	-
No. Fish started with	87	1000	3000	1060	1000	2910	500
% Loss counted	-	-	79.5%	52.0%	89.8%	84.8%	71.8%
% Fish taken out	-	-	14.2%	9.6%	0.0%	3.4%	0.0%
% Fish added	-	-	3.4%	0.0%	27.7%	0.0%	28.6%
% unaccounted for	-	-	2.9%	12.3%	3.9%	3.0%	8.8%
% Fish surviving	46.0%	10.2%	6.8%	26.1%	34.0%	3.7%	48.0%
Corrected % survival	-	-	17.6%	35.7%	6.3%	7.2%	19.4%
Length of Rearing Period in days	95	8	110	12	95	100	79

Corrected % survival = 100% - % loss counted - % loss unaccounted for.

$$\text{Total survival} = \frac{\text{Total fingerlings surviving} \times 100}{\text{Total fingerlings started}} = \frac{793 \times 100}{9,557} = 8.3\%$$

Table IV

Comparison, 1965 and 1967 Walleye Fingerling Feeding Experiments

	Year	
	1965	1967
Length fingerlings put in (mm)	44.0 to 55.0	36.2 to 39.9
Length fingerlings removed (mm)	96.0 to 102.5	91.9 to 95.5
Percent survival	24.9%	8.3%
Length rearing period (days)	81 to 92	79 to 110
No. put in	8,163	9,557
No. removed	2,030	793

Table V

Malachite Green Treatment and Fingerling Survival

Trough No.	Fingerling Length put in (mm)	Length of Rearing Period (days)	Percent Survival	Corrected Percent Survival	Time in trough before treatment (days)
6	-	95	46.0%	-	1
8	36.2	8	10.2%	-	not treated
9	36.1	110	6.8%	17.6%	9
10	38.0	12	26.1%	35.7%	1
11	37.6	95	34.0%	6.3%	1
12	39.9	100	3.7%	7.2%	treated immediately
13	-	79	48.0%	19.4%	treated immediately

Table VI

Beef Liver Feeding Rates

Date	Trough No.	No. Fish per pound	Food Fed per 24 hours as % body weight	No. Times Fed in 24 Hours	Mean Water Temperature °F
July 31	12	364	62.5%	12	77°
" 31	11	304	52.5%	12	77°
" 31	13	204	67.6%	24	77°
Aug. 8	12	196	66.4%	12	77°
" 8	11	204	36.9%	12	77°
" 14	12	172	54.3%	11	76°
" 21	12	141	44.5%	11	74°
" 28	12	116	36.7%	11	74°

Table VII

Beef Liver - Crumbles Mixture Feeding Rates

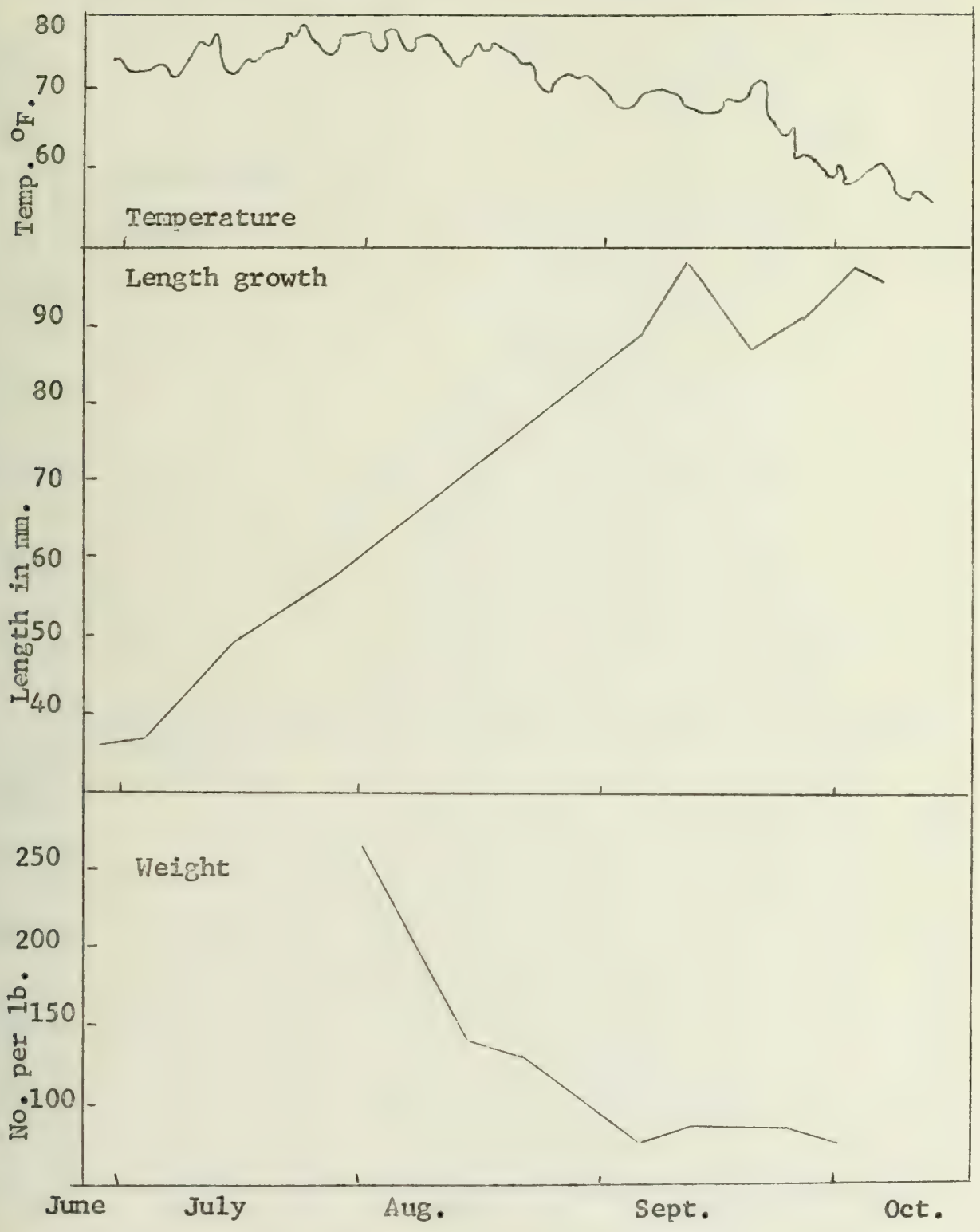
Date	Trough No.	No. Fish per pound	Food Fed per 24 hours as % body weight	No. Times Fed in 24 Hours	Mean Water Temperature °F.
Aug. 8	9	196	52.5%	12	77°
" 8	13	200	101.4%	24	77°
" 14	9	144	36.6%	11	76°
" 14	11	184	30.9%	11	76°
" 21	9	136	35.1%	11	74°
" 21	11	148	25.1%	11	74°
" 28	9	108	28.3%	11	74°
" 28	11	148	25.6%	11	74°
Sept. 5	9	78	11.2%	6	70°

Table VIII

Crumbles Feeding Rates

Date	Trough No.	No. Fish per pound	Food Fed per 24 hours as % body weight	No. Times Fed per 24 hours	Mean Water Temperature °F.
Aug. 14	13	168	84.2%	22	76°
" 21	13	156	85.2%	22	74°
" 28	13	128	36.2%	11	74°
Sept. 5	6	54	24.4%	6	70°
" 5	12	108	9.4%	6	70°
" 5	11	122	12.0%	6	70°
" 5	13	120	19.8%	6	70°
" 11	6	54	7.7%	2	67°
" 11	9	90	3.8%	2	67°
" 11	12	110	3.1%	2	67°
" 11	11	116	3.7%	2	67°
" 11	13	110	5.8%	2	67°
" 19	6	53	15.6%	2	69°
" 19	9	90	2.3%	2	69°
" 19	12	100	5.6%	2	69°
" 19	11	116	3.7%	2	69°
" 19	13	96	10.7%	2	69°
" 25	6	56	8.2%	2	62°
" 25	9	90	2.3%	2	62°
" 25	12	97	5.4%	2	62°
" 25	11	112	3.7%	2	62°
" 25	13	96	11.3%	2	62°
Oct. 2	6	48	7.1%	2	58°
" 2	9	80	2.0%	2	58°
" 2	12	92	5.3%	2	58°
" 2	13	86	10.3%	2	58°

Trough 9. Temperature, Length growth and Weight growth curves.



Time of Year

Figure 1.

Trough 11. Temperature, Length growth and Weight growth Curves

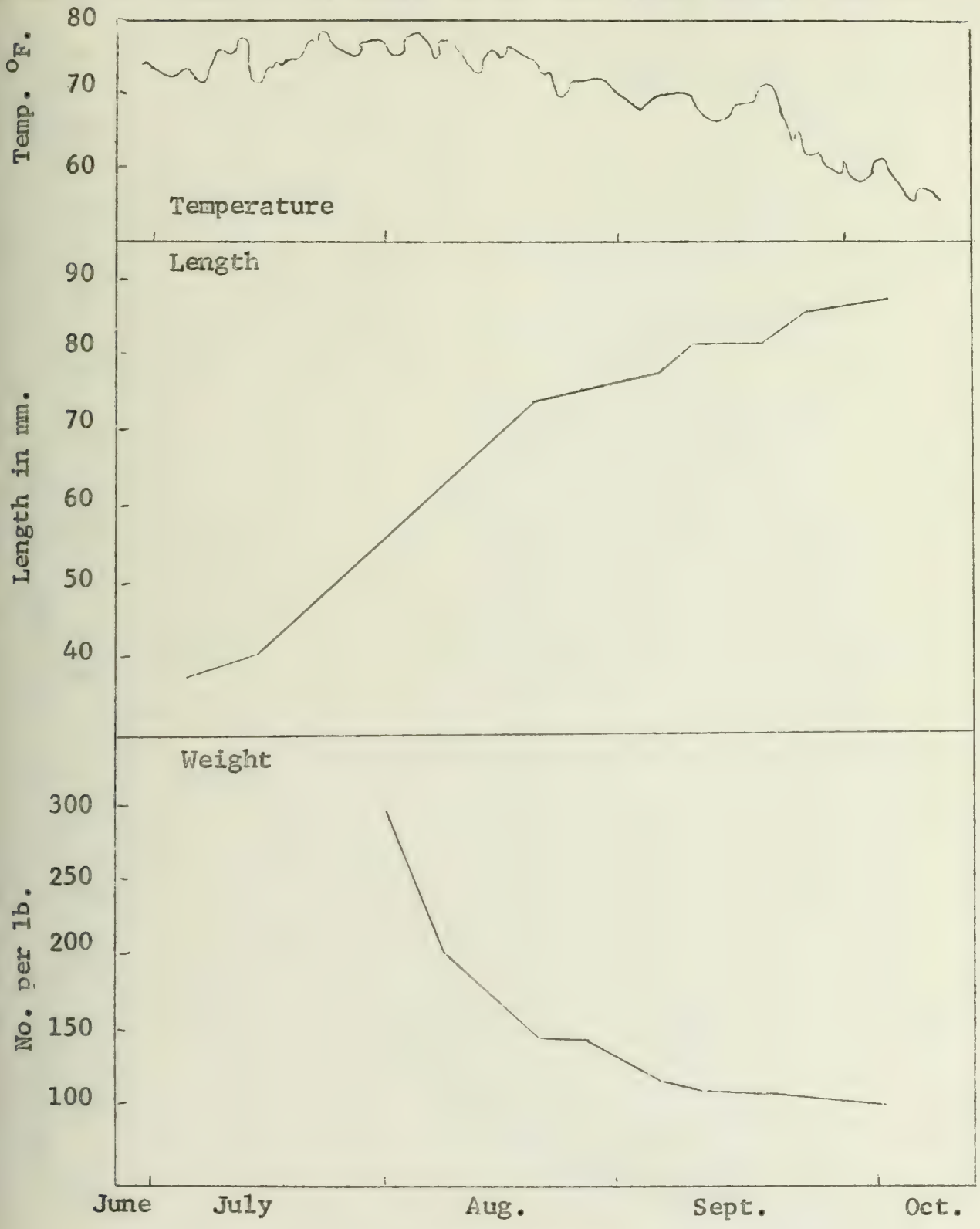


Figure 2.

Trough 12. Temperature, Length growth and Weight growth Curves

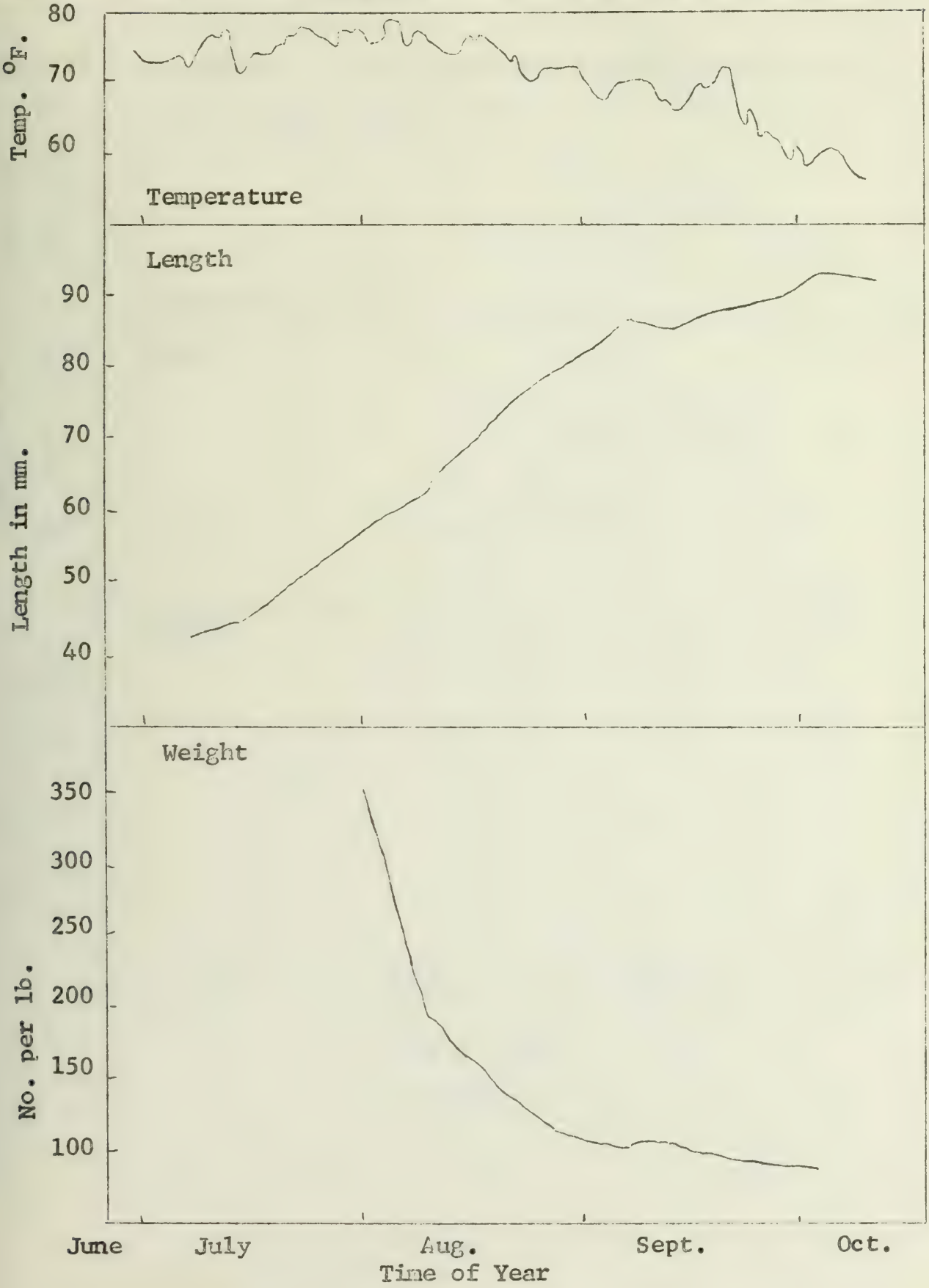


Figure 3.

Trough 13. Temperature, Length growth and Weight growth Curves.

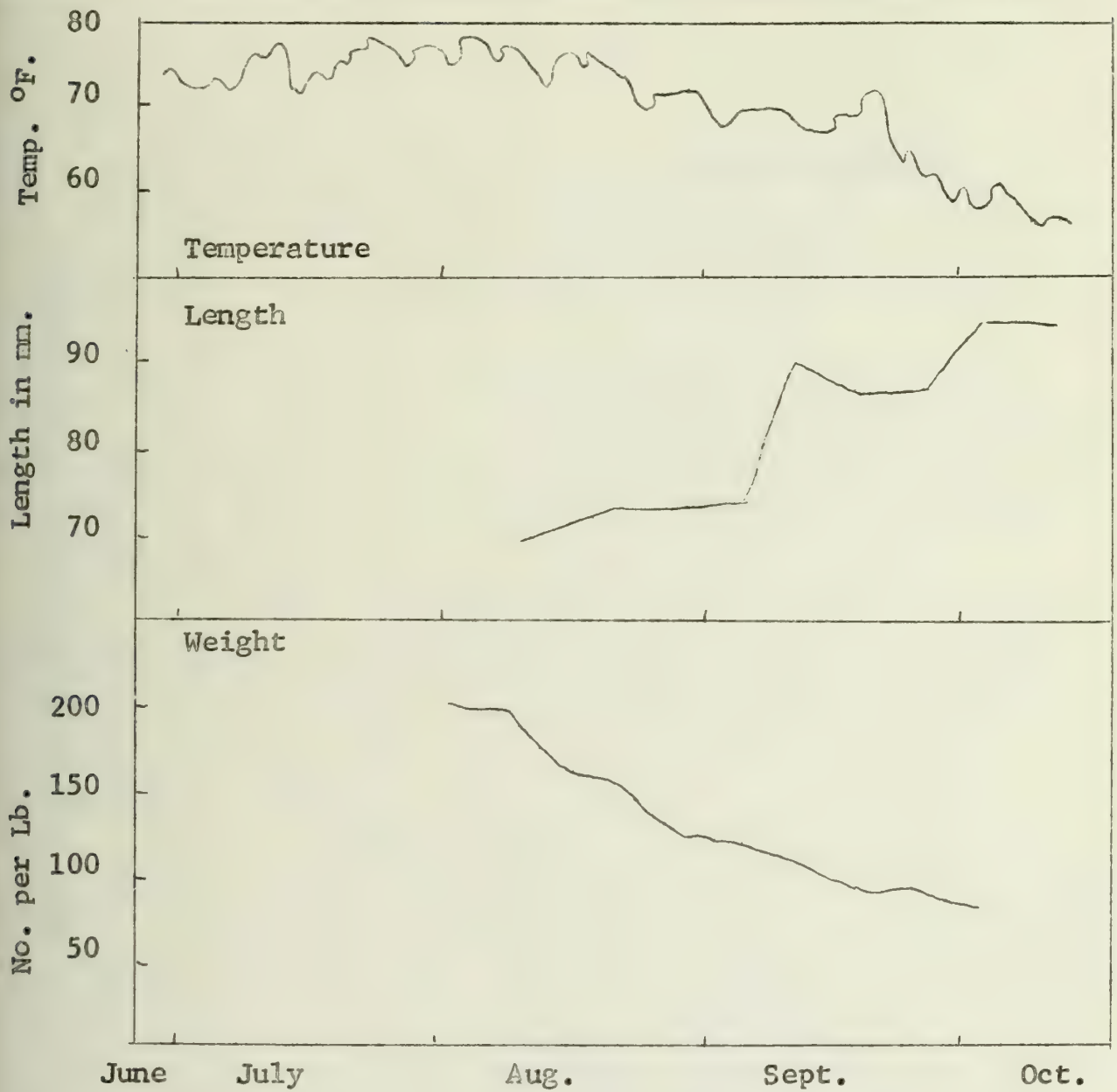


Figure 4.

Walleye Feeding Rates and Water Temperature

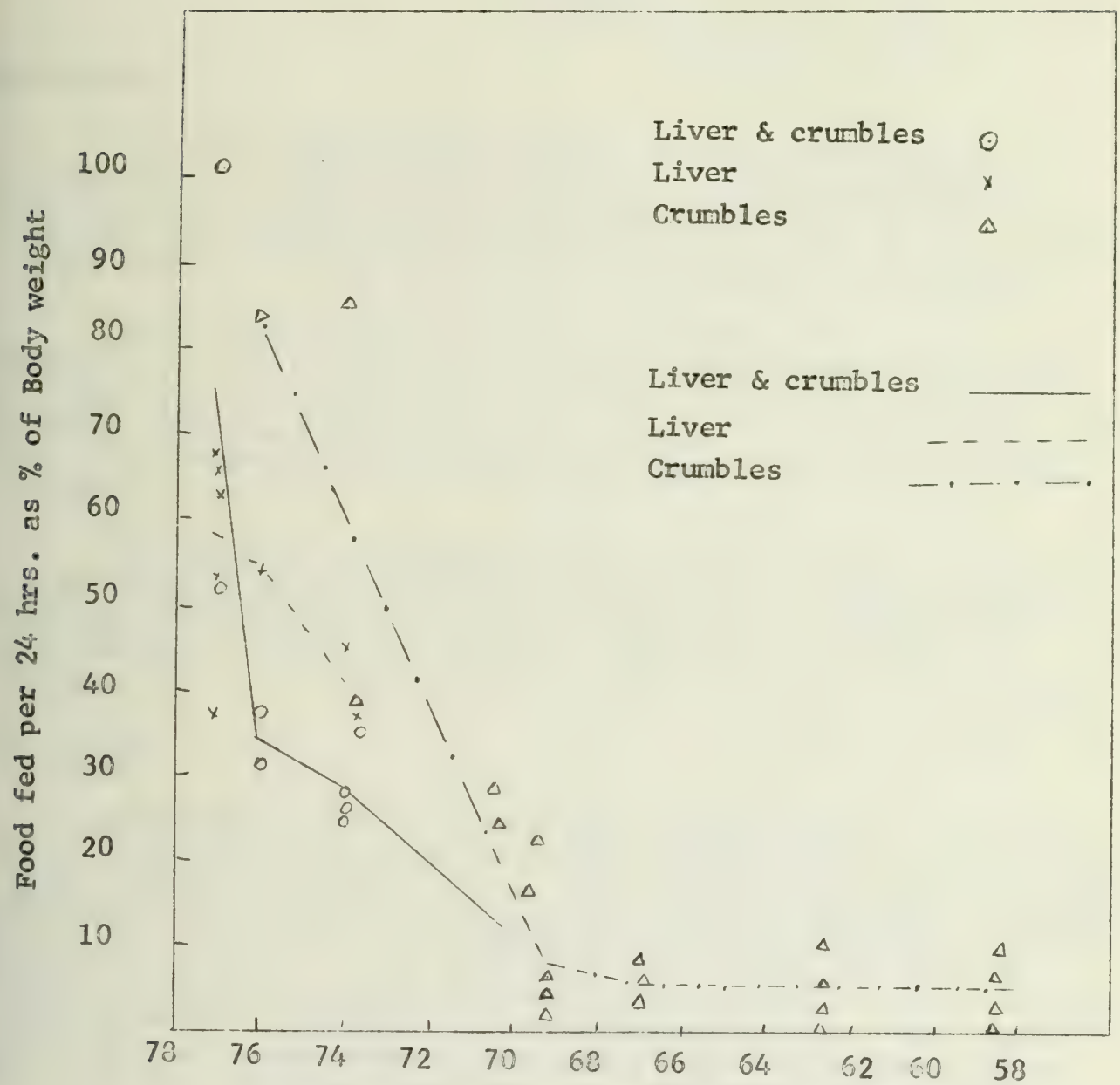


Figure 5

NORTH BAY DISTRICT RUFFED GROUSE

REPORT - 1967

by
M.E. Buss

Introduction

The 1967 ruffed grouse hunting season was a success for nearly everyone in the North Bay District. Hunters travelling by automobile on bush roads found birds abundant throughout the District. Few hunters were contacted in the field while hunting on foot and these few hunters did not enjoy the same success as road hunters.

This report contains information gathered by District Conservation Officers, District Office Fish and Wildlife personnel, other Lands and Forests staff and interested public cooperators. The information includes brood count data, hunter success data and sex and age data determined from grouse wings and tails collected during the hunting season.

The absence of one Conservation Officer during the hunting season in Management Area III resulted in a lack of hunter success information in the Townships involved (Figure 1). However, the general success of the hunt is evident even with this lack of information.

Brood Counts

Sightings of grouse broods were recorded during the months of June, July, August and early September. The procedure of recording the miles travelled on bush roads by each observer was followed quite consistently. However, a few records were made in which the observers neglected to record the miles travelled. Therefore, the data is presented in two ways. Table 1 presents the summary of grouse broods observed by month, including the corresponding mileage data. Table 2 presents the total brood summary including both the observations in Table 1 and those observations which did not have mileage data.

Table 1

Grouse Brood and Observation by Month

Including Miles Travelled

	Broods	Chicks	Chicks/ Brood	Miles Travelled	Broods/ Mile
June	1	8	8.0	45	0.02
July	52	221	4.3	1118	0.05
August	43	157	3.7	1722	0.03
September	4	20	5.0	70	0.03
Totals	100	406	4.1	2955	0.03

Table 2

Total Grouse Broods Observed

by Month

	Broods	Chicks	Chicks/Brood
June	3	16	5.3
July	54	235	4.4
August	61	261	4.3
September	4	20	5.0
Totals	122	532	4.4

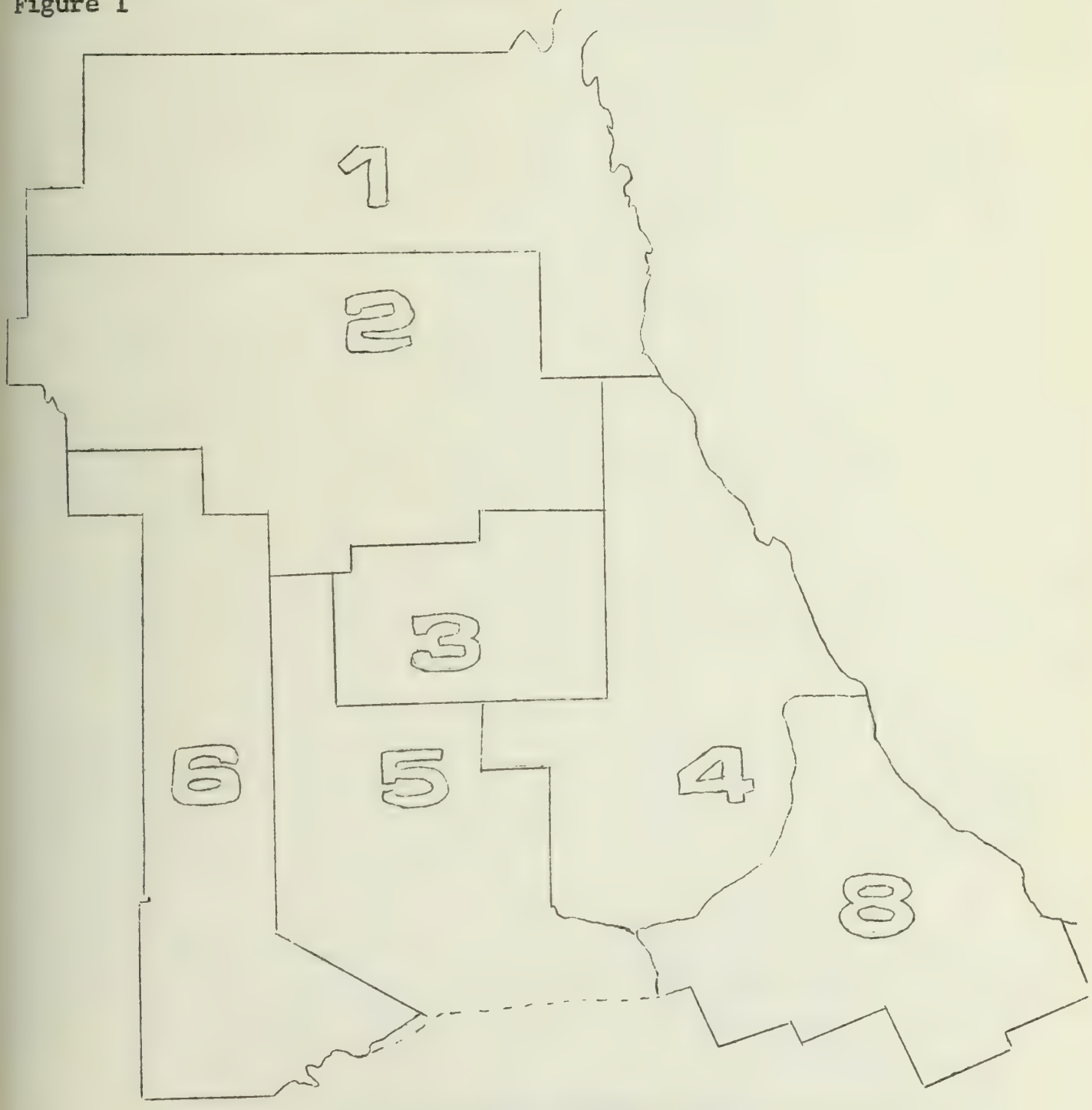
The spatial distribution of brood observations is presented in Figure 2.

A total of one hundred and twenty-two (122) broods were observed with five hundred and thirty-two (532) chicks. The overall average of chicks per brood was 4.4. This would not appear to be a great increase over last year's average. However, the method used to obtain these figures is probably not uniform. We will be making an attempt to have all observers search the areas carefully for chicks. Those observers who made a careful search reported many more chicks per brood than did more casual observers.

We also intend to continue to record miles travelled to provide a base for comparing the effort and results of the brood count.

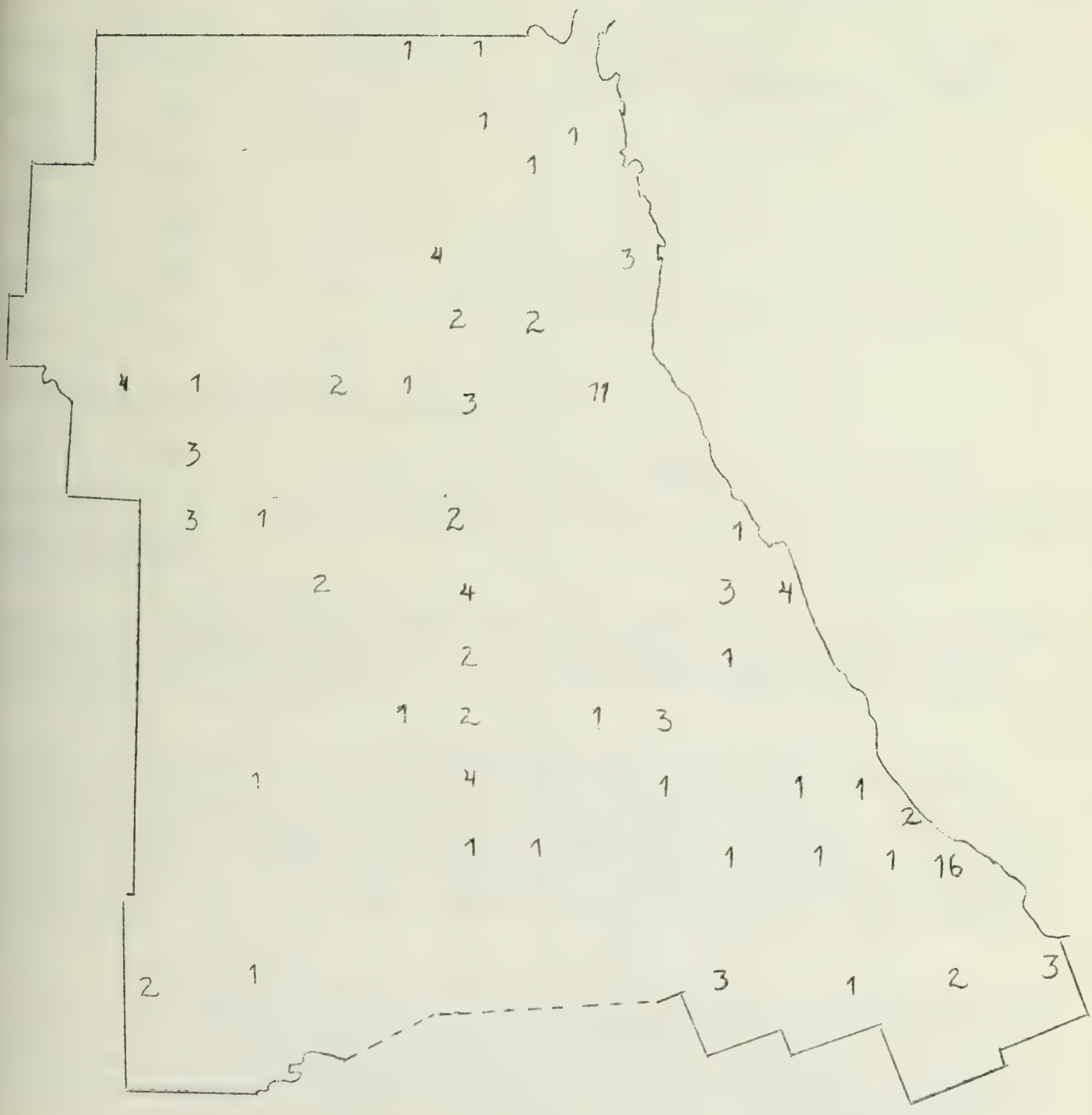
Table 3 presents a comparison of five years of brood count data collected in the North Bay District. Without the base figure of miles travelled, a meaningful trend is not evident.

Figure 1



NORTH BAY DISTRICT'S CONSERVATION OFFICER MANAGEMENT AREAS

Figure 2



DISTRIBUTION OF GROUSE BROODS
OBSERVED IN THE NORTH BAY DISTRICT DURING
JUNE, JULY, AUGUST AND SEPTEMBER, 1967.

Table 3

A Summary of Five Years of Brood Counts

in the North Bay District

Year	No. of Broods Observed	Ave. No. Chicks/ Brood	Miles Travelled	Broods/ Mile
1963	118	4.9		
1964	126	4.4		
1965	94	4.4		
1966	139	4.2		
1967	122	4.4		
(For those observed with mileage)				
1967	100	4.1	2955	0.03

Hunter Success

A total of 937 hunters were contacted in the field during the 1967 grouse hunting season. The total reported kill was 873 grouse. This is the greatest number of hunters and birds checked and recorded in the North Bay District.

The hunter success data collected in the field represents a great deal of effort by District Conservation Officers. It is safe to assume the greatest effort was spent in areas where grouse were more plentiful, more accessible and areas, therefore, receiving the greatest hunting pressure. While this may appear to bias the resulting information it may actually reflect a truer general picture of hunter effort and success.

Table 4A presents a summary of the success of hunters hunting on foot. The number of hunters contacted while hunting by foot in 1967 has declined from those in previous years. With no measure of the effort involved in contacting these hunters it is difficult to evaluate the apparent change in hunting techniques. We do feel, however, that birds were plentiful enough on bush roads allowing easy automobile travel and these hunters were enjoying good success without walking less accessible skid trails.

Table 4B presents a summary of the success of hunters hunting from automobiles on bush roads. There is a 30% increase over last year in the number of hunters contacted while hunting along roads.

Both the number of grouse seen per 100 miles driven, 16.1, and the number of grouse shot per 100 miles, 8.3, have nearly doubled the 1966 figures. Undoubtedly, our upland game hunters were pleased to have enjoyed such a fine hunting season.

There were no data reported on the success of hunters using dogs while hunting. There has generally been a deficiency of this information simply because very few hunters use dogs.

Figure 3 presents the relative distribution of grouse killed in the District during the 1967 hunting season. It is unfortunate that we are not able to show the relative distribution of effort, but it has been difficult to determine just which portion of a road hunter's effort (mileage) was driven in each of several townships reported.

Table 4A

Grouse Season Summary - 1967

Hunting on Foot	1967	1966	1965	1964
No. of Hunters	101	226	197	178
No. of Hours	236	556	502	541
No. of Grouse Seen	164*	448	361	315
No. of Grouse Shot	84*	222	175	169
Seen/100 Hours	69.5	80.6	71.3	58.2
Shot/100 Hours	35.6	39.9	34.9	31.2

*Includes 5 spruce grouse

Table 4B

Hunting by Road	1967	1966	1965	1964
No. of Hunters	836	365	241	188
No. of Miles Driven	9,532	6,047	3,976	3,082
No. of Grouse Seen	1,531*	548	452	322
No. of Grouse Shot	794*	288	280	177
Seen/100 Miles	16.1	9.0	11.1	10.95
Shot/100 Miles	8.3	4.8	7.0	5.7

*Includes 61 spruce grouse

Ratios of Sexes and Ages

Eight hundred and seventy-eight (878) ruffed and spruce grouse were reported killed according to the information gathered on the success of hunters. However, information on the sex and age of birds killed includes only five hundred and eight-two (582) birds. The birds were sexed and aged as a result of the collection of wings and tails. The reports and collections of several cooperators also account for part of the resulting imbalance of information.

Since the Management Areas in the North Bay District (Figure 1) are not ecological units, the sex and age distribution of birds killed in the District is presented as totals without other spatial differentiation. Sex and age information on 19 spruce grouse is not included in Table 5.

Table 5

Summary of the 1967 Ruffed Grouse Sex and Age Information

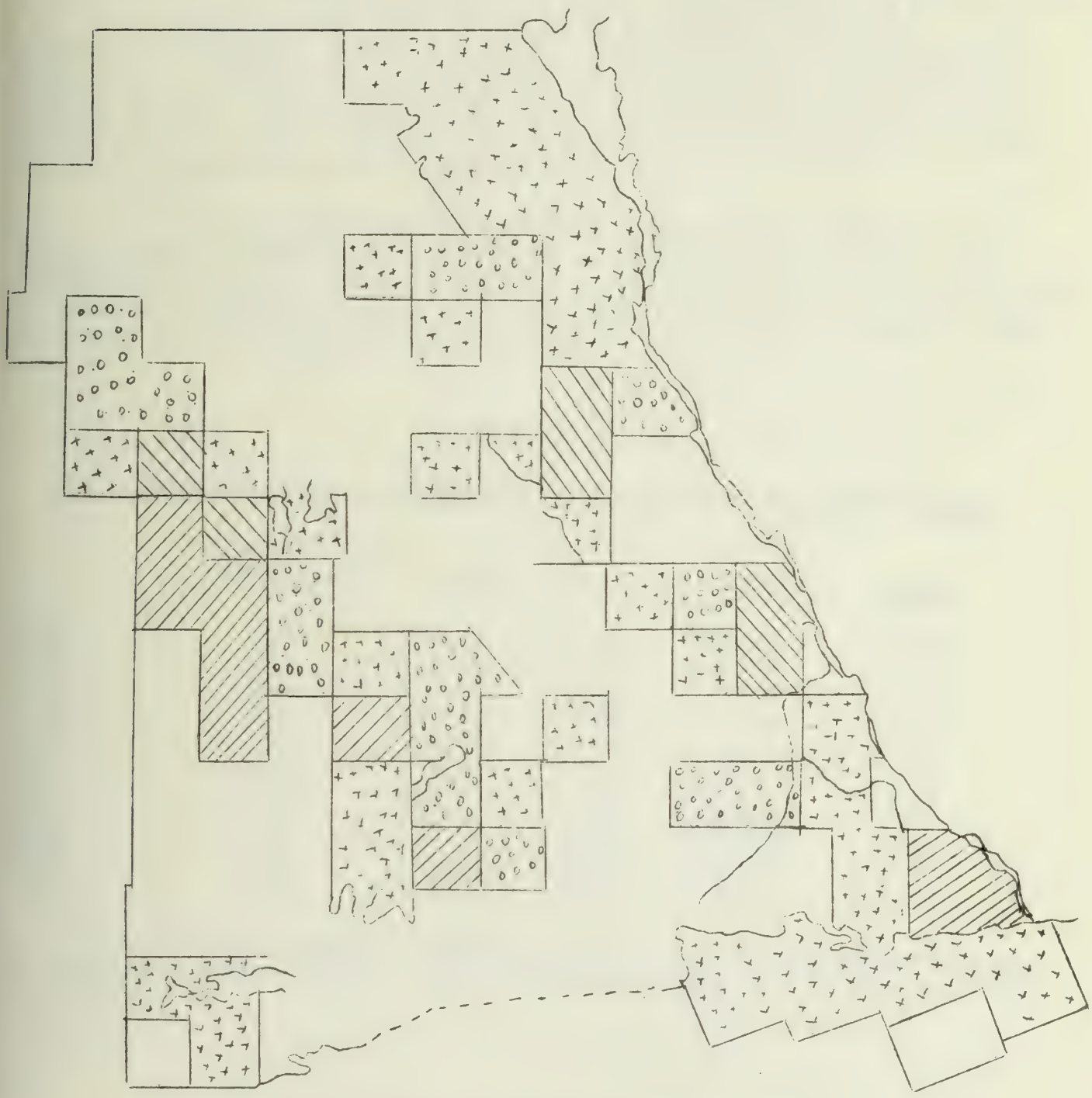
Age	No. of Males	No. of Females	Ratios	
Adult	104	69	AM:AF	1:0.66
Juvenile	177	232	JM:JF	1:1.31
			AF:J	1:5.93
			A:J	1:2.36

(Key: A=Adult, J-Juvenile, M-Male and F=Female)

Figure 3

REPORTED DISTRIBUTION OF GROUSE KILLED IN

THE NORTH BAY DISTRICT, 1967



--Key to Reported Kill Distribution--

1-10 Birds 11-20 Birds 21-30 Birds 31+ Birds

The increases in the 1967 adult female to juvenile and adult to juvenile ratios is not surprising in light of the increased hunter success. A puzzling change occurs in the juvenile sex ratio. We are confident in our data and are, therefore, undecided as to the explanation of the differential sex ratio. Unbalanced sex ratios are not uncommon in grouse, but are usually unbalanced in favour of the females (Edminster, 1947:291: Bump, Darrow, Edminster and Crissey, 1947:514). Considering the fact that the grouse cycle phenomenon itself is as yet not understood, these abnormalities cannot entirely be overlooked. Such changes in sex ratios may be part of the cyclic mechanism governing grouse productivity.

Table 6 presents the ten year comparison of ruffed grouse sex and age information. Perhaps of some significance here is the increasing ratio of juvenile females to juvenile males. There appears to be a continuing increase over the last four years, as well as the increase in juveniles to adult females.

Table 6

Ten Year Summary of Ruffed Grouse Sex and Age Information

	No. of Birds in Sample	AF:J	A:J	AM:AF	JM:JF
1958	148	1:1.11	1:0.52	1:0.90	1:1.04
1959	820	1:0.47	1:0.27	1:1.38	1:0.81
1960	685	1:1.02	1:0.60	1:1.44	1:0.79
1961	573	1:0.76	1:0.41	1:1.16	1:0.74
1962	184	1:0.83	1:0.37	1:0.81	1:0.85
1963	413	1:3.90	1:1.99	1:0.88	1:1.48
1964	706	1:4.41	1:1.86	1:0.73	1:0.79
1965	569	1:5.04	1:1.63	1:0.51	1:0.89
1966	466	1:4.88	1:2.03	1:0.78	1:0.97
1967	582	1:5.93	1:2.36	1:0.66	1:1.31

This information, although not tested statistically appears to exhibit a trend towards increasing grouse production over the last ten years.

Temporal Distribution of Kill

Figure 5 presents the accumulative percent total of hunting effort (number of hunters checked) and the percent of birds killed (number checked in hunters' bags) for each week of the hunt. To a certain extent these figures represent the effort of Conservation Officers to gather such information. However, as the effort of the Officers responds to the spatial distribution of hunters, so we may expect the effort to respond to the temporal distribution of hunters.

The temporal distribution of birds killed and hunters checked, while somewhat erratic, can be explained. The poorer success of hunters during the first weeks of the season was probably due to the fact that broods were not yet dispersed and leaf fall had not yet occurred. The increase in hunter success during and after the week of October 2 - 8 was, no doubt, due to the greater numbers of hunters in the field. This period includes Thanksgiving weekend which accounts for the increased hunting effort. Perhaps of more significance, the broods had probably been scattered by previous hunting and by the natural tendency to do so. Leaf fall had also progressed and birds were more easily seen.

Figure 4

A TEN-YEAR SUMMARY OF ADULT FEMALE

TO JUVENILE RATIO

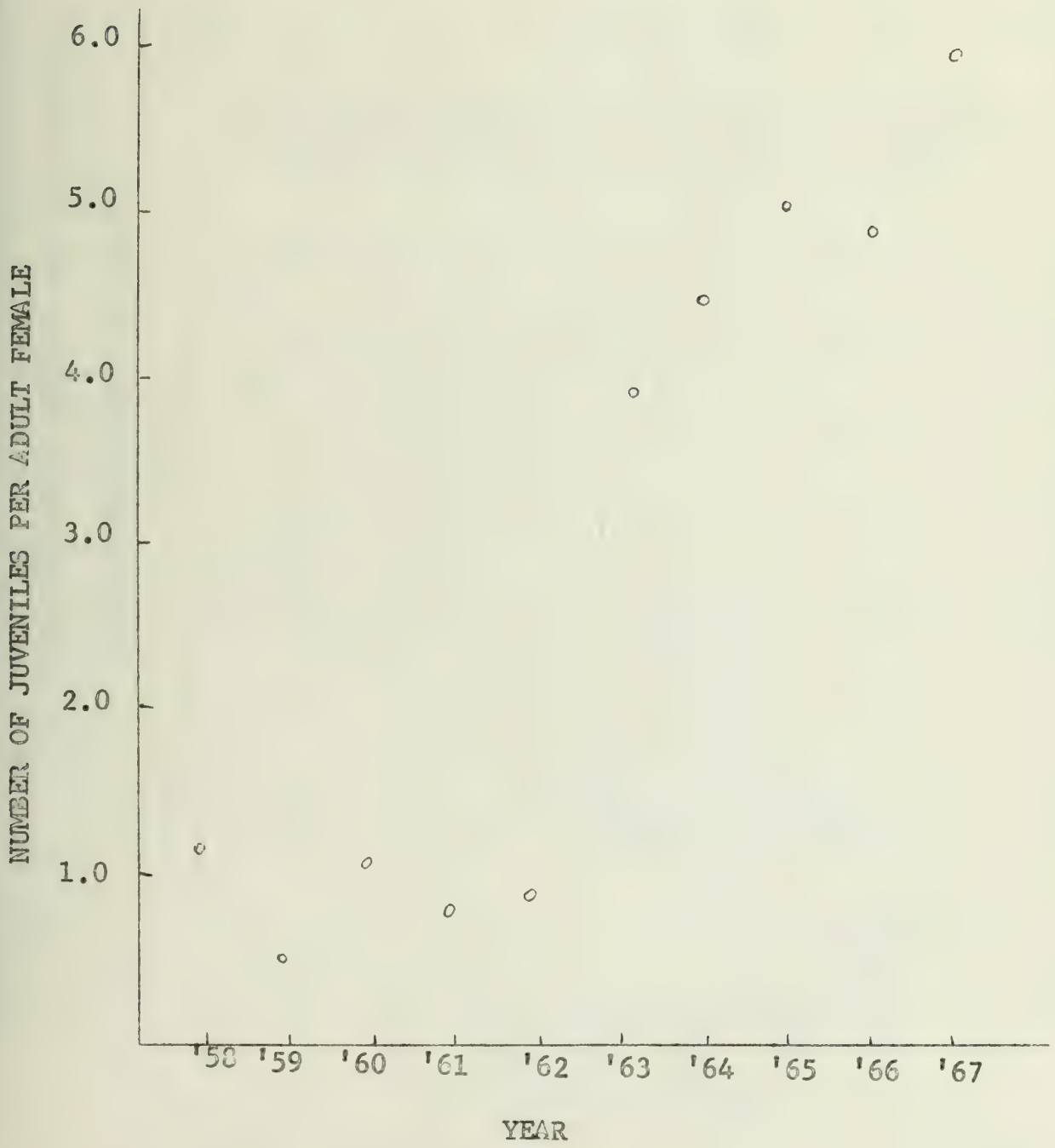
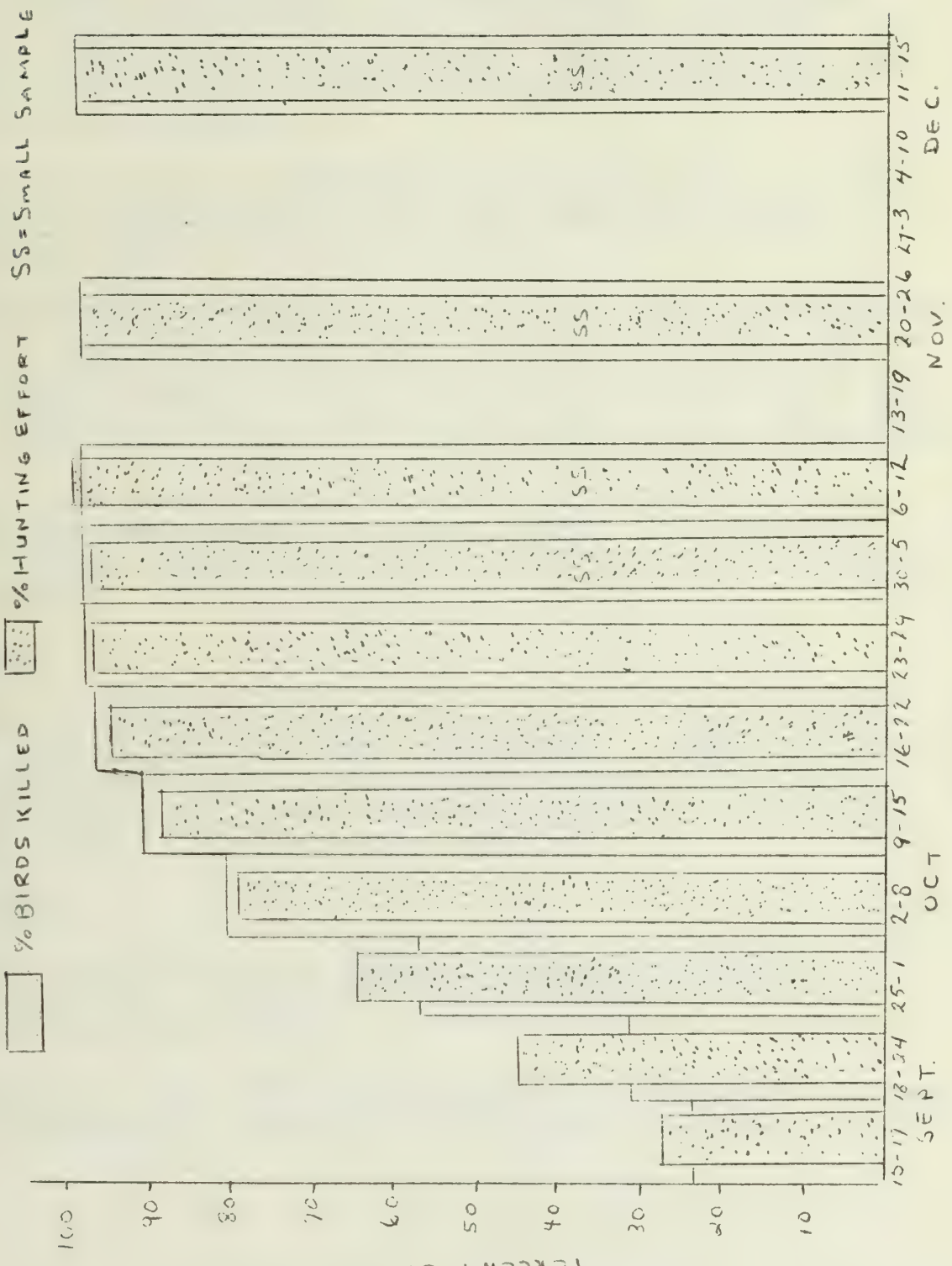


Figure 5 ACCUMULATIVE PERCENT TOTAL HUNTING EFFORT AND PERCENT BIRDS KILLED FOR EACH WEEK OF THE 1967 HUNTING SEASON (AS CHECKED IN FIELD)



Discussion and Recommendation

We believe the data presented and discussed in this report needs little further explanation. We recognize that a great deal more analysis of brood production and sex and age data could be valuable. However, time does not allow this. Also correlating these data after-the-fact, without previously designing the effort, is difficult and may be unreliable.

Further attempts to standardize the methods used to obtain information will be undertaken in the coming year, particularly as the methods apply to grouse brood observations.

We would like to abandon the grouse wing and tail collections considering the increasing work demanded from field personnel and the use of this information. Our Officers are quite competent at sex and age determinations. Perhaps setting quotas of birds to be sexed and aged in the field without collection might provide the same information.

This year questionnaires were not sent to Land Use Permit holders asking for their success in grouse hunting. We feel the reliability of these reports is doubtful. Therefore, the practice has been discontinued.

Acknowledgements

The continued cooperation and assistance of the District's Conservation Officers are greatfully appreciated. A record number of hunters were contacted in the field this past hunting season which builds greater confidence into the resulting report. We shall hope for a further effort to standardize our techniques.

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A STUDY OF HATCHING AND REARING COMMON SUCKERS (*Catostomus c. commersonii*) IN THE KENORA DISTRICT

by
B.P. Saunders

Abstract

A study was made of the feasibility of hatching and rearing common suckers for the bait fish market in the Kenora District.

It was estimated that 70 percent of the common suckers reared could have been sold by the latter part of August, and that the culture of common suckers for bait is feasible in the present market situation.

Introduction

Kenora District has a history of insufficient bait fish being available on the market during late July and August. This shortage occurs because the commercial bait fishermen are unable to harvest sufficient bait fish to meet the market's demand during this period.

This study was conducted to determine the feasibility of hatching and rearing suckers in man-made ponds. It is hoped that the culture of bait fish will help off-set the shortage which occurs in late summer. Holding ponds, will also aid in providing bait fish during periods of limited supply.

The study area was located near Kenora on private property belonging to a local bait fisherman who co-operated with the Department of Lands and Forests in this study.

Methods

Common suckers were caught during the spring spawning run in streams located at Clearwater Bay in Lake of the Woods and Black Sturgeon Lake. A large dip net was used to catch the spawning suckers and 10 to 15 were held in a 45-gallon barrel, half filled with fresh water until stripping began.

Stripping eggs and milt from suckers is quite simple. The eggs were expressed into a clean wet pail and immediately the milt of a male was stripped over the eggs. Eggs and milt flow freely from ripe fish when light pressure is applied by moving the thumb and forefinger over the abdomen towards the vent. Several (five or six) female and male fish may be stripped into the pail.

The eggs and milt were gently stirred by rocking the pail to and fro so that the sperm would reach all the eggs. After the eggs and milt were thoroughly mixed, a small amount of water was added and stirring continued for two or three minutes. The excessive milt was then washed off the eggs by changing the water in the pail several times.

Sucker eggs have a tendency to clump or stick together. Clumping should be prevented because eggs which stick together are unable to obtain sufficient oxygen and will die. Dead eggs are extremely prone to being attacked by fungus. To prevent clumping, a cup of clay and water of the consistency of pea soup was stirred in with the sucker eggs after the excessive milt had been washed out. The clay and water mixture coats the eggs and prevents clumping. The excessive clay was then washed out with clean water and the sucker eggs were left to harden in a liberal amount of clean, fresh water for an hour before being transported to the hatchery. The eggs are very easily injured if they are not allowed to harden.

Four quarts of sucker eggs (approximately 130,000 eggs) were placed in four Meehan hatching jars. The number of eggs obtained from a female sucker is dependent upon the size and spawning condition (ripeness) of the fish. It is estimated an adult female will lay 30,000 to 130,000 eggs (Mackay, 1963). The number of male fish used in fertilizing the eggs was equal to the number of female fish stripped. The hatching jars were housed in a small wooden shelter for protection.

Water was piped to a storage tank in the hatchery through a one-inch water line by gravity flow from a man-made pond. The water flow in the hatchery jars was regulated by individual valves from the storage tank. The man-made pond was approximately an acre and a half in size and averaged four feet in depth. It contained water collected by natural drainage from the adjacent land and water pumped into it from the nearby Winnipeg River. This pond was later used as the rearing pond for the sucker fry. Throughout the summer, water was pumped periodically from the Winnipeg River into the rearing pond. This assured that the water in the pond did not become stagnant at any time.

The water in the pond was chemically analyzed in the latter part of June 1967, using a DR-EL Hach Water Analysis kit with the results shown below.

Oxygen	-	7.5 ppm
Carbon Dioxide	-	8.0 ppm
Nitrates and Nitrates	-	24.0 ppm
Phosphates	-	0.1 ppm
Alkalinity	-	75.0 ppm
pH	-	6.3

Daily maximum and minimum water temperatures were recorded in the hatchery during the incubation period. Maximum and minimum water temperatures were recorded in the rearing pond at a depth of two feet below the surface from May 14, 1967 to August 20, 1967.

The fry were introduced to the rearing pond within 48 hours after hatching. No other species of fish were in the rearing pond during the entire study. The sucker's growth was checked volumetrically and linearally throughout the summer and early fall. Growth rates were determined by capturing 100 suckers at random and then measuring the number of milliliters of water their bodies displaced and by measuring their total lengths in millimeters.

The rearing pond was partially drained and seined on November 2, 1967 and an estimate of the production of suckers was made. The study was concluded on November 2, 1967 as the pond was required to store other species of bait fish over the winter.

Results

Two jars of sucker eggs were placed in the hatchery on May 17, 1967 and were incubated until May 29, 1967. This batch of eggs required 285 degree-days to hatch. Two other jars of sucker eggs were started on May 19, 1967 and hatched on May 30, 1967-- requiring 277 degree-days to hatch. (A degree-day is one Fahrenheit degree above 32° F. for 24 hours.) The number of degree-days required to hatch the two separate lots of eggs is exceedingly similar, but the slight difference may be due to inequalities in their respective incubating temperatures, or the fact that the sucker eggs were collected from two different areas. The number of degree-days was calculated by using the average temperature of the hatchery water each day during the incubation period.

An estimated 80 percent of the eggs hatched (calculated by volume) in each of the four hatching jars, resulting in approximately 104,000 fry being stocked in the rearing pond.

The maximum and minimum hatchery water temperatures were recorded daily during incubation. The record of these temperatures is illustrated in Figure 1. Figure 11 is the record of the weekly maximum and minumum temperatures in the rearing pond from May 14, 1967 to August 26, 1967. The only exception being the period from July 2, 1967 to August 12, 1967 when only one reading was taken in that period. Figure 11 illustrates that the suckers had very favourable water temperatures during the entire summer for rapid growth, as the temperature was normally between 65°F. and 75°F. The lethal water temperature for common suckers occurs at 85°F.

Four growth rate checks were made throughout the study period with the results tabulated below. (Method of checking growth rate discussed under METHODS section).

Date	Total Volume (Mls.)	Average Total Length (MM.)
June 26, 1967	7	19 (0.7 inches)
August 9, 1967	150	53 (2.1 inches)
August 30, 1967	170	59 (2.3 inches)
November 2, 1967	240	67 (2.6 inches)

The rearing pond was seined on November 2, 1967 to determine the production of the suckers. Ten imperial gallons of common suckers were removed from the rearing pond and graded. Thirty percent of the suckers were graded into the medium bait size range (average 3.5 inches long), ranging from 3.0 inches to 4.5 inches in length while the remaining 70 percent were deemed small size bait (average 2.5 inches long, ranging from 2 inches to almost 3 inches in length). Three gallons of medium sized suckers (3.5 inches) is equivalent to 175 dozen or 2,100 fish, while seven gallons of small-sized suckers (2.5 inches) represent 1,239 dozen or 14,863 fish.

Discussion

The total production of the suckers could have been increased by more intensive management of the pond. Predators were very important in reducing the sucker populations. The most important predators were aquatic insects which were observed capturing and devouring many sucker fry. When the suckers reached the fingerling stage, other

predators such as Great Blue herons, Mergansers, American bitterns, Belted Kingfishers, mink and turtles, were observed feeding on the suckers.

The first step would be to remove or greatly reduce the number of predators which occurred in and around the rearing pond. Kerosene or No. 2 fuel oil may be used to control air breathing aquatic insects because the oil makes breathing impossible. (Dobie et al., 1956). The suggested rate of kerosene is 10 to 12 gallons per surface acre of the water (Dobie et al., 1956)*. The oil should be applied to the pond in the spring and later removed by overflowing the pond's surface water. Herons, bitterns and other wading birds which prey on fish can be discouraged by ponds with steep banks. The steep banks prevent the wading birds from having a place to stand and fish. Posts along the pond's edge, over-hanging trees and any object which provides a perching site over the surface of the water should be removed. The removal of these perches will prevent kingfishers from preying on the fish. The use of traps, baited hooks and "scarce devices" will also aid in the removal or the frightening away of predators (Dobie et al., 1956).

It was estimated that 30 percent of the suckers were of marketable size in early August, while 70 percent could have been sold by late August or early September. In Minnesota, it has been demonstrated that the total production in a pond can be greatly increased by selectively harvesting the bait fish several times during the growing season (Dobie et al., 1956). This selective harvesting provides more room and food for the remaining fish.

Approximately 16 percent of the fry stocked survived to November 2, 1967 when the pond was seined. This is very similar to the survival rate of 17 percent which occurred in a Minnesota pond stocked at approximately the same rate as the pond in this study.

Artificial feeding and fertilizing of the rearing pond would enable more fish to be grown to a marketable size in the first season (Forney, 1958). This does not imply, however, that fish died from a lack of food.

*No introduction may be made of a deleterious material into public waters, or into private waters which may subsequently drain into public waters, except under the authority of a permit issued by the Ontario Water Resources Commission.

The retail value of the suckers seined on November 2, 1967 was approximately $750.00.

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Forney, J.L. 1958. Raising Bait Fish and Crayfish in New York Ponds. Cornell Extension Bull. 986. pp, 13-17.

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Fig. 1 DAILY MAXIMUM AND MINIMUM WATER TEMPERATURES IN SUCKER HATCHERY

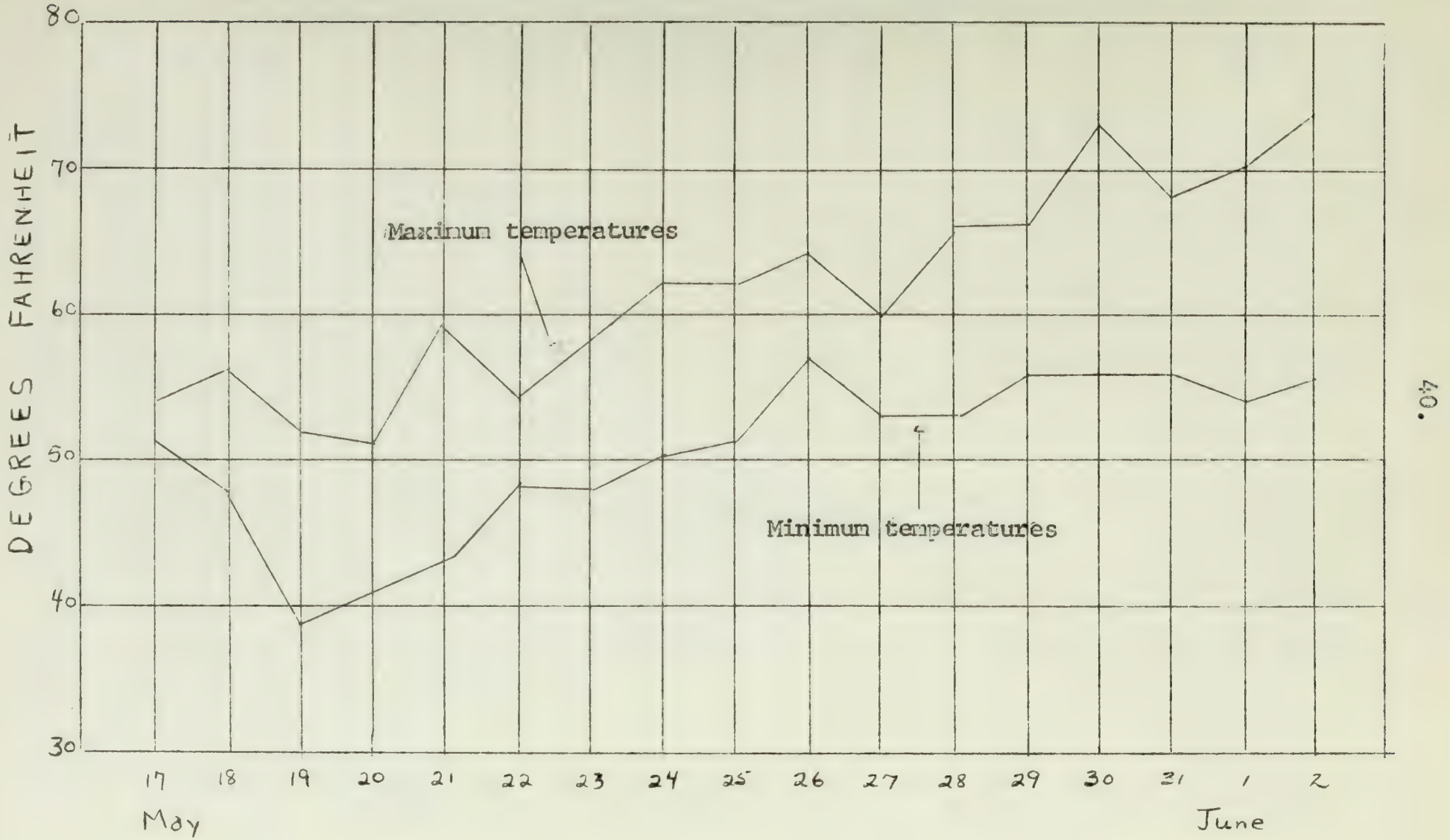
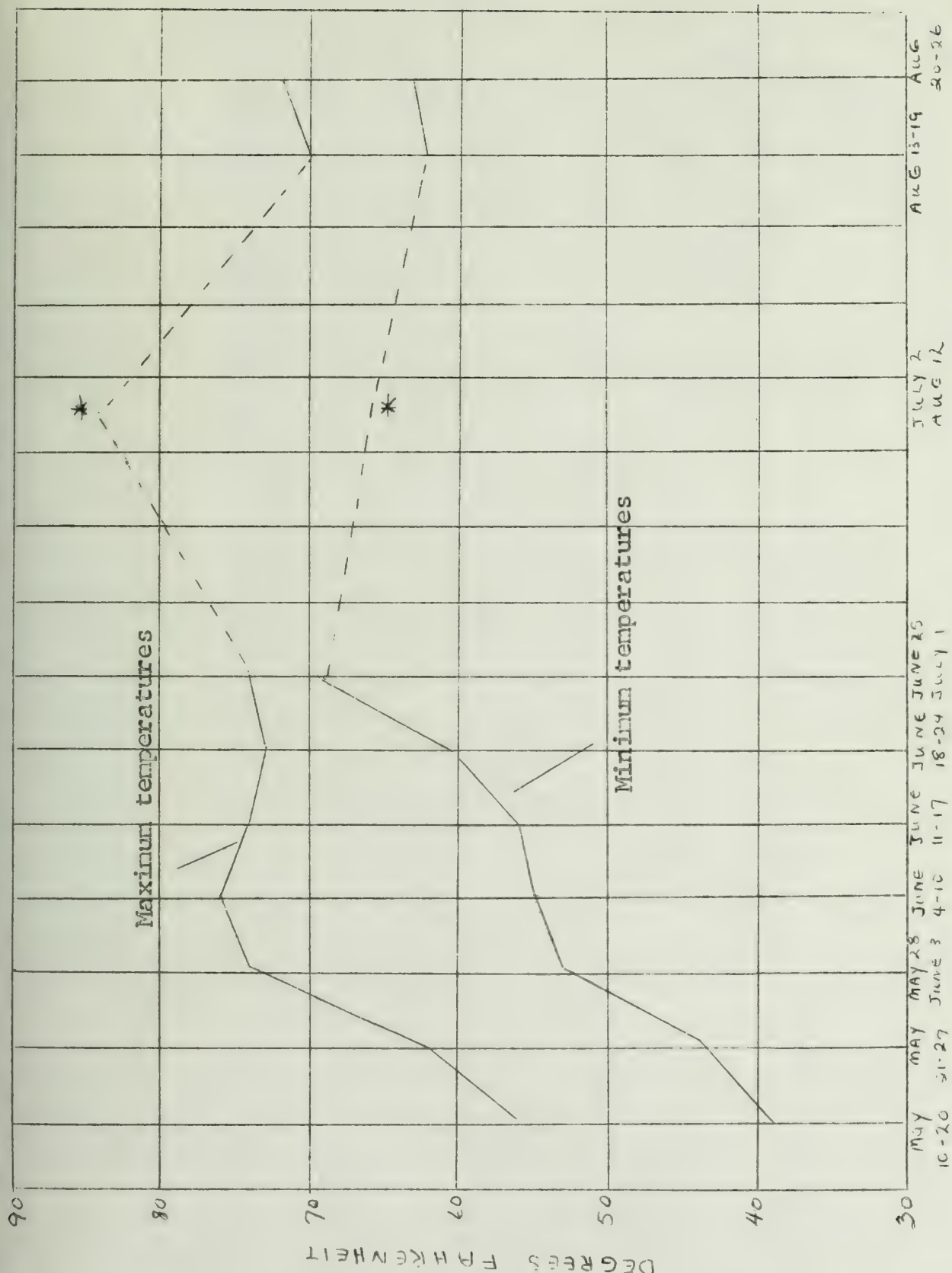
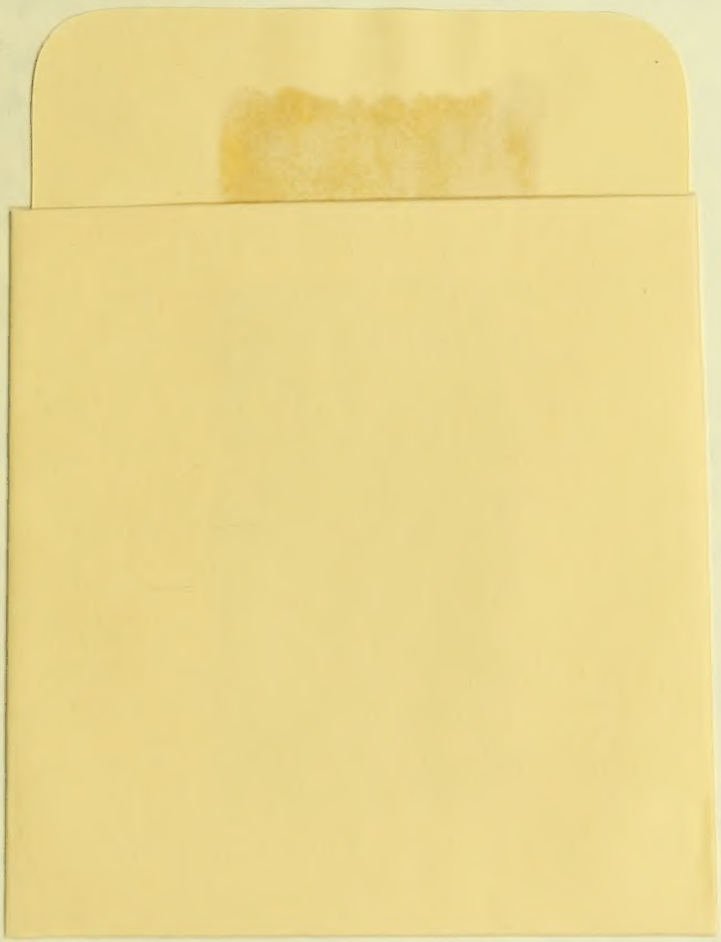


Fig. 2 MAXIMUM AND MINIMUM WATER TEMPERATURES AT SUCKER REARING POND



*Only one reading was made in the period July 2-August 12, 1967.